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10/006,462	12/04/2001	Steven R. Walther	V0077/7165WRM	5689

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EXAMINER	
CROWELL, ANNA M	

ART UNIT	PAPER NUMBER
1763	

DATE MAILED: 02/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/006,462	WALTHER, STEVEN R.	
	Examiner	Art Unit	
	Michelle Crowell	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 November 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-33* is/are pending in the application.

4a) Of the above claim(s) *6-9,15-17 and 28-33* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5, 10-14, and 18-27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Status of Claims

Claims 1-33 are pending in the application. Claims 6-9, 15-17, and 28-33 are withdrawn from consideration. Claims 1-5, 10-14, and 18-27 stand finally rejected.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liebert et al. (U.S. 6,020,592) in view of Foster et al. (U.S. 5,567,243) and Vesnovsky et al. (U.S. 6,209,481).

Referring to Figure 1 and column 4, line 32-column 5, line 33, Liebert et al. discloses a plasma doping apparatus comprising: a plasma doping chamber 10; a platen 14 located in the plasma doping chamber for supporting a semiconductor wafer 20 (col. 4, lines 32-36); an anode 24 spaced apart from the platen in the plasma doping chamber (col.4, lines 44-46); a process gas source 36 coupled to the plasma doping chamber, wherein a plasma containing ion of the process gas is produced in a plasma discharge region between the anode and the platen (col.5, lines 4-8); a pulse source 30 for applying pulses between the platen and the anode for accelerating ions from the plasma into the semiconductor wafer (col.4, lines 50-57, col.5, lines 22-33).

Liebert et al. fails to teach a mechanism for rotating the semiconductor wafer with rotational speed in a range of about 10-600 rpm for averaging azimuthal uniformity variations over the surface of the semiconductor wafer.

Referring to Figure 2 and column 12, line 36-column 14, line 48, Foster et al. discloses a plasma processing apparatus comprising a mechanism for rotating the platen 46 such that the semiconductor wafer 48 rotates about its center at a rotational speed between 0-2000 rpm to ensure uniform processing and desired processing rate (col. 13, lines 49-65, col. 8, lines 23-25). Additionally, plasma is pumped down to the substrate by using a rotating platen (col.4, lines 30-31). Moreover, referring to column 1, lines 62-65 and column 8, lines 37-40, Vesnovsky et al. teaches it is well known to use a mechanism for rotating the semiconductor wafer in a plasma doping apparatus in order to ensure uniform implantation. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the platen of Liebert et al. with a rotating mechanism that rotates at speeds in a range between 0-2000 rpm as taught by Foster et al. and Vesnovsky et al. in order to pump the plasma down to the substrate and achieve uniform processing or implantation. Additionally, it should be noted that since the plasma is non-uniform in the apparatus of Liebert et al. in view of Foster et al. and Vesnovsky et al., rotating the semiconductor wafer ensures that all of the exposed semiconductor wafer surface is processed by the entire non-uniform plasma environment, and thus achieve uniform doping or "averaging azimuthal uniformity variations" on the semiconductor wafer. Furthermore, with respect to the claimed limitations of "averaging azimuthal uniformity variations", it should be noted that claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function.

With respect to claim 3, the pulse source of Liebert et al. has a pulse rate of 100 Hz to 2 kHz which is capable of operating at a faster rate than the rotational speed of Foster et al. at 0-2000 rpm.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claim 5 is rejected under 35 U.S.C. 102(b) as being anticipated by Nakayama et al. (Japanese Patent Publication 01-022027).

Referring to Drawing 1 and the abstract, discloses a plasma doping apparatus comprising: a plasma doping chamber 1 containing a platen 4a for supporting a workpiece 6; a plasma source 10 for generating a plasma in the plasma doping chamber and for accelerating ions from the plasma into the workpiece; and a drive mechanism for rotating the semiconductor wafer. Additionally, it should be noted that since the plasma is non-uniform in the apparatus of Nakayama et al., rotating the workpiece ensures that all of the exposed workpiece surface is processed by the entire non-uniform plasma environment, and thus achieve uniform doping or "averaging azimuthal uniformity variations" on the workpiece. Furthermore, with respect to the claimed limitations of "averaging azimuthal uniformity variations", it should be noted that claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function.

5. Claims 10-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liebert et al. (U.S. 6,020,592) in view of Hirata (Japanese Patent Publication 57-023227).

Referring to Figure 1 and column 4, line 32-column 5, line 33, Liebert et al. discloses a plasma doping apparatus comprising: a plasma doping chamber 10; a platen 14 located in the plasma doping chamber for supporting a workpiece 20 (col. 4, lines 32-36); a process gas source 36 coupled to the plasma doping chamber, wherein a plasma containing ion of the process gas is produced in a plasma discharge region between an anode and the platen (col.5, lines 4-8); an anode 24 spaced apart from the platen in the plasma doping chamber, the anode having a spacing from the platen that is varied and adjusted for accelerating ions from the plasma into the workpiece (col.4, lines 44-46); a pulse source 30 for applying pulses between the platen and the anode for accelerating ions from the plasma into the workpiece (col.4, lines 50-57, col.5, lines 22-33).

Liebert et al. fails to teach the anode comprises two or more anode elements and actuators for individually adjusting the spacing between the anode and the platen.

Referring to Drawings 3, 4, 5, and 10 and the abstract, Hirata teaches a plasma processing apparatus wherein the anode comprises two or more anode elements 9, 10, 11 and actuators 15, 16, 17 for individually adjusting the spacing between the anode elements 9, 10, 11 and the platen 3 in order to obtain an uniform processing rate. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention for the anode of Liebert et al. to have two or more anode elements and actuators for individually adjusting the spacing between the anode and the platen as taught by Hirata in order to achieve an uniform processing rate.

Liebert et al. fails to teach that the two or more anode elements comprise annular rings.

Referring to Drawings 5 and 10, Hirata teaches a plasma processing apparatus wherein the two or more anode elements comprises an alternate shape of annular rings 74, 75,76. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention for the anode elements to be annular rings as taught by Hirata since this a known alternative configuration for plasma processing anodes. Additionally, the shape (annular rings) of the claimed anode elements is considered a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular shape of the claimed anode elements are significant.

6. Claims 18-20, 22-25 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liebert et al. (U.S. 6,020,592) in view of Setoyama et al. (U.S. 6,196,155).

Referring to Figure 1 and column 4, line 32-column 5, line 33, Liebert et al. discloses a plasma doping apparatus comprising: a plasma doping chamber 10; a platen 14 located in the plasma doping chamber for supporting a workpiece 20 (col. 4, lines 32-36); an anode 24 spaced apart from the platen in the plasma doping chamber (col.4, lines 44-46); a process gas source 36 coupled to the plasma doping chamber, wherein a plasma containing ion of the process gas is produced in a plasma discharge region between the anode and the platen (col.5, lines 4-8); a pulse source 30 for applying pulses between the platen and the anode for accelerating ions from the plasma into the workpiece (col.4, lines 50-57, col.5, lines 22-33).

Liebert et al. fails to explicitly teach that the chamber having a cylindrical geometry.

Referring to column 2, lines 25-26, Setoyama et al. teaches a plasma processing apparatus having a chamber with a cylindrical geometry. It is conventionally known in the art

for a chamber to have a cylindrical geometry. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to for the chamber of Liebert et al. to have a cylindrical geometry since this feature is conventionally known in the art.

Liebert et al. fails to teach a plurality of magnetic elements disposed around the plasma discharge region

Referring to Figure 1 and column 4, line 52-column 6, line 49, Setoyama et al. teaches a plasma processing apparatus having a plurality of magnetic elements 20a and 20b disposed around the plasma discharge region for efficiently confining the plasma for processing and easily maintaining the plasma density (col.6, lines 1-4). Additionally, the magnetic elements are disposed on or near the anode 9. Furthermore, the magnetic elements are arranged in one or more annular rings (col. 5, lines 1-2). Moreover, the magnetic elements 20a and 20b have alternating polarities facing the plasma discharge region (col. 5, lines 1-6). Also, the magnetic elements 20b are arranged in a cylindrical array around the plasma discharge region (col. 5, lines 4-6). In addition, the magnetic elements produce cusp magnetic fields 30 in a region adjacent to the plasma discharge region (see Fig. 1). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the apparatus of Liebert et al. with the magnetic elements disposed around the plasma discharge region as taught by Setoyama et al. in order to efficiently confine the plasma for processing and to easily maintain the plasma density

7. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liebert et al. (U.S. 6,020,592) in view of Setoyama et al. (U.S. 6,196,155) as applied to claims 18-20, 22-25 and 27 above, and further in view of Shan et al. (U.S. 6,022,446).

The teachings of Liebert et al. in view of Setoyama et al. have been discussed above.

Liebert et al. in view of Setoyama et al. fail to teach magnetic elements which are radially aligned to form a spoke configuration.

Referring to Figure 4a and column 8, lines 23-49, Shan et al. teaches a plasma processing apparatus wherein the magnetic elements 90 are radially aligned to form a spoke configuration. With this spoke configuration, a radially symmetrical magnetic field is generated to enhance processing rates. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to arrange the magnetic elements of Liebert et al. in view of Setoyama et al. in a spoke configuration as taught by Shan et al. since a radially symmetrical magnetic field is generated to enhance processing rates.

8. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liebert et al. (U.S. 6,020,592) in view of Setoyama et al. (U.S. 6,196,155) as applied to claims 18-20, 22-25 and 27 above, and further in view of Goeckner et al. (U.S. 6,182,604).

The teachings of Liebert et al. in view of Setoyama et al. have been discussed above.

Liebert et al. in view of Setoyama et al. fail to teach a hollow electrode surrounding the plasma discharge region.

Referring to Figure 2a-b and column 5, line 26-column 6, line 6, Goeckner et al. teaches a plasma doping apparatus which uses a hollow electrode 300 surrounding the plasma discharge region in order to produce a more uniform plasma at a lower gas pressure. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the apparatus of Liebert et al. in view of Setoyama et al. with a hollow electrode surrounding the

plasma discharge region as taught by Goeckner et al. in order to produce a more uniform plasma at a lower gas pressure. Additionally, the apparatus of Liebert et al. in view of Setoyama et al. and Goeckner et al. is capable of positioning magnetic elements near the hollow electrode.

9. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liebert et al. (U.S. 6,020,592) in view of Setoyama et al. (U.S. 6,196,155) as applied to claims 18-20, 22-25 and 27 above, and further in view of Little et al. (U.S. 4,443,488).

The teachings of Liebert et al. in view of Setoyama et al. have been discussed above.

Liebert et al. in view of Setoyama et al. fail to teach a hollow electrode surrounding the plasma discharge region.

Referring to Figure 1 and column 2, line 55-column 4, line 46, Little et al. teaches a plasma processing apparatus which uses a hollow electrode 22 surrounding the plasma discharge region 12, wherein magnetic elements 30 are disposed near the hollow electrode in order to produce a large volume, low pressure, high temperature plasma yielding very high energy, charged ions. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the apparatus of Liebert et al. in view of Setoyama et al. with a hollow electrode surrounding the plasma discharge region as taught by Goeckner et al. in order to produce a large volume, low pressure, high temperature plasma yielding very high energy, charged ions.

Response to Arguments

10. Applicant's arguments filed November 25, 2005 have been fully considered but they are not persuasive.

Applicant has argued that since Foster et al. is directed to CVD processes in which a film is deposited on a substrate, a process for rotating the semiconductor wafer which averages azimuthal uniformity variations is not suggested because the invention is a plasma doping processing. Applicant further argued that CVD and doping are unique and different processes. However, both CVD processing and doping are analogous art since they both solve problems in the field of plasma processing. Additionally, the only difference between a doping apparatus and a CVD apparatus is the type of gas used during processing and thus the apparatus of Liebert et al. could be used as a CVD apparatus or the apparatus of Foster et al. could be used as a doping apparatus simply by changing the process gases (i.e. depositing gases, doping gases). Furthermore, in plasma processing systems it is well known that the plasma distribution is non-uniform. One way of compensating for the non-uniformity is to rotate the semiconductor wafer which allows all of the semiconductor wafer surface to be processed by the whole non-uniform plasma environment and therefore achieve an uniform process (i.e. depositing or doping) or "averages azimuthal uniformity variations" on the semiconductor wafer. Moreover, a claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed **(i.e. a process for rotating the semiconductor wafer which averages azimuthal uniformity variations)** does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. Lastly, Vesnovsky et al. teaches rotating a semiconductor wafer during a plasma doping process (ion implanting-col. 8,

lines 36-39). Additionally, the applicant has argued that Vesnovsky et al. fails to suggest a single wafer process; however, as seen in Figure 1 and Figure 6 (col. 4, lines 37-38), Vesnovsky et al. does teach a single wafer process. Thus, the rejection using Liebert et al. in view of Foster et al. and Vesnovsky et al. satisfy the claimed requirement.

Applicant has argued that Hirata fails to teach varying and adjusting the spacing between an anode and platen for accelerating ions from the plasma into the semiconductor wafer. However, as discussed in new rejection using Liebert et al., Liebert et al. clearly discloses varying and adjusting the spacing between an anode and platen. Furthermore, a claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed **(i.e.** varying and adjusting the spacing between an anode and platen **for accelerating ions from the plasma into the semiconductor wafer**) does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. Thus, since the Liebert et al. teaches the structure for varying and adjusting the spacing between an anode and platen, the rejection using Liebert et al. satisfies the claimed requirement.

Applicant has argued that Setoyama et al. or Shan et al. fails to teach controlling the radial density distribution of the plasma so that the dose uniformity of the ions implanted into the semiconductor wafer is improved. It should be noted that the present invention is apparatus claims and the requirement for apparatus claims is for the prior art to teach all the structural limitation of the claim. As stated above, a claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed **(i.e. controlling the radial density distribution of the plasma so that the dose uniformity of the ions implanted into the semiconductor wafer is improved)** does not differentiate the claimed apparatus from a prior art

apparatus" if the prior art apparatus teaches all the structural limitations of the claim. Thus, in claim 18, Setoyama et al. teaches the structure of a plurality of magnetic elements disposed around the plasma discharge region and Shan et al. teaches the structure of a spoke configuration, therefore the rejection of Liebert et al. in view of Setoyama et al. and Shan et al. satisfies the claimed requirement.

Applicant has argued that Nakayama et al. fails to teach rotating the semiconductor wafer which averages azimuthal uniformity variations. It should be noted that the present invention is apparatus claims and the requirement for apparatus claims is for the prior art to teach all the structural limitation of the claim. As stated above, a claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed **(i.e. rotating the semiconductor wafer which averages azimuthal uniformity variations)** does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. Thus, in claim 5, Nakayama et al. teaches the structure rotating the semiconductor wafer, therefore the rejection of Nakayama et al. satisfies the claimed requirement.

Conclusion

12. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michelle Crowell whose telephone number is (571) 272-1432. The examiner can normally be reached on M-F (9:30 -6:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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